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PSYCHOLOGICAL LITERATURE.

I.—EXPERIMENTAL PSYCHOLOGY.

Zur Psychophysik des Lichtsinns. Von HJALMAR NEIGLICK. Philosophische Studien, IV, 1, pp. 28-112.

This is a continuation of the experimental study begun by Dr. Lehmann in the former number of the *Studien*. The method used is that of the "mean gradations," and consists in rapidly rotating three discs, each containing a certain amount of black and white, so that in rotating a uniform gray of a lighter or darker tint is produced, and in requiring the observer to regulate the amount of black on one of these discs so that it shall produce a gray exactly intermediate between the constant grays of the darker and the lighter discs. If the amount of black on the adjustable disc proves to be the *mean proportional* between that on the light and that on the dark disc, Weber's law holds.

Lehmann's elaborate study brought out the many sources of error in this experiment, and above all, the enormous effect of the contrast of the disc with its background. It was found best to set each disc against a background of its own tint; this can readily be done for the two constant discs, but seems difficult to do for the medium disc without giving the observer a clue as to the tint he ought to choose. Neiglick solved this problem by having the background itself a disc much larger than the one to be adjusted, but similarly marked as to white and black, so that when both rotate on a common axis, the adjustable disc, like the others, is seen against its own background. With all these precautions it was found that in a general way Weber's law held, and seemed to hold the more rigidly the more carefully the experiment was conducted. But a new result, on which Professor Wundt, in a note to this article, lays much stress, is that the absolute difference in grayness between the extreme discs affects the validity of the law: in other words, while the mean proportional between x and y is \sqrt{xy} , and the mean proportional between $\frac{1}{2}x$ and $2y$ is also \sqrt{xy} , yet, as a fact, the adjustment of the one pair will be nearer the mean proportional than that of the other pair. And the difference between the discs in which the law has its greatest validity corresponds to that relation of the tints of the two discs at which the researches of Lehmann showed that the maximum amount of mutual contrast occurs. For example, a setting in which the one disc is entirely white and the other 40° of black is one of the relations at which the law most closely holds. An interesting discussion of the bearing of the phenomena of contrast on Weber's law closes the article.

Two remarks may be added to the account of this research: the first is that it proves the extreme intricacy of this psychophysical method, and yields an excellent instance of the way in which side effects can entirely distort the law of a series of phenomena; the

second remark is that, important as these results are, the author has no right to subject one to the reading of 84 pages to winnow them out. This lengthiness is a fault common to many of the studies from the Leipzig laboratory. J. J.

Zur Theorie der Gesichtsempfindungen. Von J. v. KRIES. Arch. f. Anat. u. Physiol., 1887, p. 113.

In a paper published in 1878 Kries stated a law of physiological optics, that lights composed of different colors which seemed alike to the unfatigued or neutral eye seemed alike also to the eye however fatigued, and two years ago he was led to conclude from further experiments that if the physiological effect of two objectively different light-mixtures was identical, the identity remained if the intensity of the lights was increased or diminished in the same ratio. The first of these laws was new, and the second perhaps implied in the broader law of Grassmann and Helmholtz that lights that appear equal give mixtures that appear equal, but has been more recently questioned. More recent experiments by Hering confirm both laws. From the first law Kries has developed an objection to Hering's theory of visual sensation as follows: A light composed of red and green may seem to an unfatigued eye identical with a light composed of yellow and blue. If the eye be now fatigued, *e. g.* for red, the first light ought on Hering's theory to seem greenish on account of the change in his red-green visual substance, while the other light which did not affect this substance would remain unchanged. The two mixtures, however, do remain the same. Hering accordingly modifies his theory, or, as he says, the statement of it, as follows: We must conceive, he tells us, that yellow and blue light are not without effect on the red-green visual substance and *vice versa*, but represent stimuli of dissimulation and assimilation of equal strength. In other words, he adds to his theory the conception that a light may have at the same time on the same substance two opposite effects, and that these effects must be equally intense for all five of his valences. This v. Kries thinks extremely artificial and improbable, as much so as if two chemically distinct substances should give exactly the same spectrum. With more than three components it requires improbable and *ad hoc* assumptions to explain the facts. Again, if a blue and a white light seem equally bright, they cease to do so if the intensity of both is increased in equal relation. This simple fact, says v. Kries, is absolutely irreconcilable with Hering's theory. So is the fact lately placed beyond all doubt by König and Dieterici, that those that are born color-blind fall naturally into two great groups, the red and green blind. Thus the Young-Helmholtz demarkation of components is again confirmed. The advantage of the latter theory is that it apprehends the effects of light so nearly as they are known in photo-chemistry. Since the discovery of the chemical effects of light on the retina, the conception of different substances in the retina has gained ground, and also that their decompositions represent the components of the Young-Helmholtz theory. The fact that the sensations of heat and cold, once thought to represent two opposite processes in the same nerve, is now known by the discovery made independently by Dr. Donaldson in the psycho-physic rooms of this University and by Dr. Goldscheider, now of Berlin, that these two sensations have distinct nerves and terminal organs, destroys the only analogy that supported the theory of Hering, which will be quite abandoned.